PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Fly Wheel Starting or Driving Mechanism

I, ALBERT VICTOR CLARKE, of 2, Went Road, Birstall, Leicestershire, a British Subject, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a fly wheel starting and driving mechanism and has for an object to provide effective and economical means for accumulating mechanical energy.

In accordance with the invention there is provided mechanism for starting up and/or driving a heavy fly wheel from a low power high speed prime mover comprising a cam shaft adapted to be driven through a reduction gear from the prime mover, a driving shaft adapted to be coupled to the fly wheel, spring actuated means for imparting driving impulses to the driving shaft and means on the cam shaft for periodically loading the spring of said spring actuated means during rotation of the cam shaft. Thus during the operation of the mechanism the cam shaft causes a succession of loadings of the spring to occur in the intervals between which the spring becomes unloaded in applying driving impulses to the driving shaft. In a preferred form of the mechanism there are provided a plurality of spring actuated means acting at different positions on the driving shaft and each associated with separate spring loading means on the cam shaft which are timed to operate in sequence during the rotation of the cam shaft. Thus in effect at each rotation of the cam shaft the plurality of spring actuated means have their springs loaded in sequence and thereby caused to impart a succession of pulses to the driving shaft which are cushioned due to the resilience of the springs and spread over the period of unloading thereof.

By the use of apparatus in accordance with the invention a heavy fly wheel can be started up from rest and caused to rotate a high speed in a particularly effective, economical and expeditious manner, the fly wheel then being caused to drive any desired machine or apparatus. The mechanism may be employed to maintain the fly wheel rotating by continuing to supply a succession of cushioned impulses to its driving shaft or alternatively other driving means (such as a second prime mover) may be brought into action to maintain the speed of rotation of the fly wheel after it has been brought up to full speed. It will be appreciated that the power required from such second prime mover is only that necessary to prevent the fly wheel from losing speed and is substantially less than that which would be needed by a direct drive to start the fly wheel into motion from rest in a short period of time. Such second prime mover would be chosen or designed as one suitable to supply the requisite power for the drive which is to be taken from the rotating fly wheel.

In a convenient form of construction the spring actuated means for applying cushioned impulses to the driving shaft (or each of a plurality of such means) comprises a one way clutch and a spring which in its loaded state urges the driving member of such clutch in the direction to engage its driven member and thereby transmit a drive to the driving shaft. The spring actuated means and one way clutch device and the means for their operation may take various forms which are hereinafter more fully described. In one form levers operated against the action of coil springs are used the movements of the lever under the action of such springs being used to impart impulses to the driving shaft though a one way clutch. In other constructions a rotary driving clutch member on the driving shaft is directly actuated to give driving impulses by a spring or springs contained in the clutch assembly and such spring may take the form of a strip coiled around the axis of the driving shaft. In the latter case the spring may be contained in a hollow drum which is turned stepwise about the axis of the driving shaft to lead the spring for imparting impulses to the driven clutch member.

[*Price 3s. 6d.*]

Certain preferred constructions in accordance with the invention are illustrated by way of example in the accompanying drawings and will now be described with reference to those drawings in which

Figure 1 is a plan view of one arrangement for starting up a fly wheel,

Figure 2 is a side elevation of the arrangement of Figure 1, and

Figures 3, 4 and 5 are detail views illustrating alternative arrangements of spring actuated means associated with one way clutch devices.

Referring firstly to Figures 1 and 2 there is shown somewhat diagrammatically a frame work 10 carrying an extension frame work 11 in bearings in which there is rotatably mounted a shaft 12 to which is secured to fly wheel 13. The shaft 12 is coupled by gears 14, 15 to a shaft 16 which in turn is coupled by gears 17, 18, to a stub shaft 19 and thence through gears 20 and 21 to a driving shaft 22. Thus driving impulses from shaft 22 are transmitted through the gears just described to the spindle 12 of the fly wheel 13. The stub shaft 19 is preferably so arranged that change gears may be substituted in place of gears 18, 20 and 21 to vary the ratio of the gearing between shafts 22 and 12 as may be desired. On the shaft 22 are mounted a plurality of one way clutches 23, four being shown by way of example. Each such clutch embodies a driven member secured to shaft 22 and a driving member rotatable on the shaft the driving and driven members being so arranged in known manner that when the driving members are turned in one and the same direction they are automatically coupled to the driven members to impart driving impulses thereto but when turned in the opposite direction or when the driven members over-run the driving members free relative movement between them is permitted. The driving members of the one way clutches 23 are secured respectively to gear wheels 24.

It will be seen that the shafts 16 and 22 extend through the main frame work 10 parallel to one another and that a further shaft 25, herein referred to as a cam shaft, is also mounted in the frame work parallel to shafts 16 and 22. Above the shaft 25 is an upstanding frame structure 26, 27 forming an upward extension of frame work 10 and supporting at an elevated position a pivot rod 28 on which are mounted for rocking movement depending arms 29 associated respectively with the four one way clutches 24. The shaft 25 is driven by a chain 30 and chain wheels 31, 32, From a further shaft 33 which is the output shaft of a reduction gear box 34 the drive to which is obtained from a low power high speed electric motor 35 through chain 36 and chain wheels 37 and 38. On the shaft 25 are two discs 39 spaced apart and each having camming projections 40 of which there are two projecting from each face of each disc, and each preferably formed as a sleeve or roller rotatable on a pin secured to its disc. The cam projections 40 are so arranged that on each side of each disc the two projections are 180° apart and the projections on one side of each disc are offset by 90° from the projections on the other side of the disc. The two discs 39 are also so co-related on the shafts 25 that the projections of one disc are offset by 45° from the projections on the other disc. The cam projections 40 are positioned to co-operate with the tails of levers 29 so that as cam shaft 25 is rotated each lever 29 will be rocked twice in each rotation of the shaft and no two levers will be rocked at the same time, the spacings of the cam projections 40 being such that the four levers 29 are rocked in regular sequence.

At the right hand end of the frame work 10 upstanding brackets 41 support between them a pivot rod 42 on which are rockably mounted four long levers 43 pivoted near their centres on pivot rod 42. The upper ends of levers 43 have connected to them long coil tension springs 44 which extend to fixed anchorages on a rod 45 supported by a fixed bracket 46 upstanding from near the other end of the frame work 10. The springs 44 thus serve to load the levers 43. The latter are respectively rocked against the action of springs 44 by the next described mechanism when the levers 29 are actuated by the cam projections 40.

Associated with each lever 29 is a long chain 47 which extends from an anchorage 48 on lever 29 around an idler sprocket 49 freely mounted on a spindle 50 supported between frame brackets 27, thence around an idle sprocket 51 carried by lever 29 near its free end, thence around sprocket 24 of the appropriate one way clutch, and around an idle sprocket 52 on the lower end of the appropriate lever 43 to a fixed anchorage 53 on the frame. Thus when a lever 29 is rocked by engagement with one of the cam projections 40 during rotation of cam shaft 25 the chain 47 is drawn around the axis of sprocket 24 causing its length extending from sprocket 24 around sprocket 52 to fixed anchorage 53 to be substantially reduced thereby rocking the appropriate lever 43 against the action of its spring 44 and such lever 43 becomes loaded. By such movement of the chain, sprocket 24 is rotated in the direction in which free movement occurs between the driving and driven members of the one-way clutch until lever 29 passes over the cam projection which has operated it and becomes released. Small movement of lever 43 causes sprocket 24 to turn through more than half a complete rotation. Thereupon the appropriate spring 44 urges lever 43 in the direction to cause return movement, thereby exerting drag on the lower part of the chain to rotate sprocket 24 on one way clutch in the direction to engage the clutch.

Further rotary movement of sprocket 24 causes a driving impulse to be applied from spring 44 through the chain 47 to the driven shaft 22. Due to coupling of such spindle to the fly wheel 13 a cushioned driving impulse is applied by the action of spring 44 against the inertia of the fly wheel.

The levers 29 are bissed by tension springs 168 serving to urge the levers in the direction to maintain the chains 47 taut these springs being much weaker than the springs 44. The cam shaft 25 is provided with a friction brake 169, 170 to exert a sufficient retarding action on the rotation of the shaft to prevent any tendency for instantaneous changes in its speed such as might otherwise occur whenever a lever 29 rides off its operating cam projection 40.

It will be appreciated that in operation with the motor 35 energised to rotate the cam shaft 25 a succession of impulses is applied through the four levers 29 to load the respective springs 44 which become released in sequence to apply sequential impulses through the one-way clutches 23 to the driving shaft 22. Such driving impulses are of a cushioned nature by reason of the yieldable action of springs 44 and as a consequence the fly wheel 13 may be started up from rest and accelerated in a smooth and regular manner, the action being such that starting of the fly wheel and acceleration to the required speed is secured smoothly and quickly.

By way of illustration the fly wheel 13 is shown as being connected to drive a load through a chain 54 and chain wheels 55 and 56, shaft 57, releasable clutch 58 and chain 59 and chain wheels 60 and 61. The load chosen for example is an alternator 62 or other electric generator. The mechanism so far described may be utilised to maintain the fly wheel 13 rotating at the required speed continuously or if desired a further driving motor 63 may be provided for coupling to the fly wheel to maintain its rotation as soon as it has attained full speed. The motor 63 is shown as coupled by a chain 64 and chain wheels 65 and 66 to shaft 16 through a disengageable clutch 67. Thus when the fly wheel has been started up and attained full speed motor 63 may be operated and connected by clutch 67 to maintain rotation of the fly wheel 13, the motor 35 then being disengaged. It may be an advantage for the purpose of improving the efficiency of the system to feed back some of the power of the alternator or generator 62 to the driving motor 63 to assist the latter in maintaining the speed of the fly wheel. As the motor 63 is merely required to keep the fly wheel 13 rotating at its full speed, only a relatively low power motor is needed for this purpose.

When the impule applying mechanism just described is not in use it is advantageous to be able to release all tension on the springs 44. For this purpose hand levers 68 are pivoted at 68a to the long levers 43 and formed with notches 68b and 68c to co-operate with pins 69a on brackets 69 attached to the frame work 10. When the impulse applying mechanism is in use the notches 68c are engaged with pins 69a to draw the springs 44 taut. To relax the springs 44 the arms 68 are lifted and shifted to bring the notches 68b into engagement with the pins 69a.

With a view to simplifying the apparatus and securing a more compact arrangement of parts, any of the modified arrangements of the spring actuated means for engaging the one way clutches as shown somewhat diagrammatically in Figures 3 to 5 may be employed. In Figure 3 the modified driving arrangement for ony one of the one way clutches is shown and in place of each clutch 23 of Figure 1 there is provided a modified clutch incorporating spring actuated engaging means. Thus each such clutch comprises a driven member 70 and a driving member 71 the former being fixed to a shaft 22 and the latter free to turn thereon. Associated with the driving member 71 is a fixed disc like plate 72 shown diagrammatically as being held against turning by an arm 73 connecting it to a fixed anchorage 74. Between fixed plate 72 and driving member 71 there are arranged peripherally a plurality of springs 75 spaced around these members and each having one end anchored to the fixed plate and the other end anchored to the driving member 71 as at 76 and 77 respectively. The driving member 71 has a projecting lug or arm 78 which is coupled by a link 79 directly or indirectly to the appropriate lever arm 29 which receives impulses from the cam projections 40 on one of the discs 39. When an impulse is applied to lever 29 to rock it as in the previous construction the motion of this lever is transmitted through linkage 79 to the driving member 71 of the one way clutch 70, 71 causing the latter to turn in the free direction and load the springs 75. On release of lever 29 the springs 75 act to turn the driving member 71 in the opposite or engaging direction causing engagement of the clutch whereupon the springs 75 apply a driving impulse to the shaft 22. Compression springs may be substituted for the springs 75 and a chain sprocket drive may be substituted for the operation of driving member 71 in place of the link 79 and link arm 78.

In the second modified arrangement illustrated in Figure 4 the driving member 71 of a one way clutch 70, 71 is coupled to a spring drum 80 (similar to that of the spring motor of a gramophone) having secured to it a sprocket wheel 81 around which chain 47 passes, the latter being arranged as in the construction of Figures 1 and 2 except that its lower part is acted on by a tension lever 82 carrying a sprocket 83 around which the chain 47 passes on its way to a fixed anchorage 84,

the lever 82 being acted on by a spring 85. The spring drum 80 contains a spirally wound plate spring 86 the outer end of which is attached to the drum 80 and the inner end of which is anchored to a fixed sleeve 87 on which the drum 80 can turn and which embraces shaft 22, the sleeve 87 being held stationary by an arm 88. With this modified construction actuation of the lever 29 by the cam projections 40 causes chain 47 to be moved round the driving shaft 22 and turn the spring drum 80 and with it the driving clutch member 71 in the free direction so as to load the spring 86 which, on release of lever 29, is caused to act on the driving member 71 and turn it in the direction to engage it with the driven clutch member 70 and apply a driving impulse to shaft 22 until the spring has become relaxed or a further impulse is applied to lever 29.

Figure 5 illustrates a modification wherein the driving and driven members of a one way clutch are indicated at 89, and 90, the driven member 90 being secured to shaft 22 while the driving member 89 is mounted for free turning movement being secured to a sleeve 91 which is rotatable on shaft 22. The sleeve 91 passes centrally through a spring drum 92 having secured to it a ratchet wheel 93 and containing a spirally wound plate spring 86 as in the construction of Figure 4. The inner end of spring 86 is anchored to sleeve 91 and its outer end is anchored to the drum 92. Co-operating with the ratchet wheel is a check pawl 94 carried by a fixed part 95 and also a pawl 96 carried on a rock arm 97 which swings freely on the sleeve 91. The rock arm 97 is connected by a link 98 to the appropriate lever arm 29 which is fitted with a return spring 99.

In the operation of the arrangement of Figure 5 impulses applied to lever arm 29 by cam projections 40 serve periodically to rock the arm 29 so that rocking motions are given to rock arm 97 through link 98 causing pawl 96 to turn the drum 92 in the direction to wind up the spring 86 the check pawl preventing unwinding movements of the drum. The force of spring 86 when under load is applied through sleeve 91 to the driving member 89 of the one way clutch urging it in the engaging direction to transmit driving impulses to driven member 90 and shaft 22. It will be noted that with this construction no movement of driven member 89 in the free direction is imparted to it from the lever arm 29 and a succeeding impulse applied to the spring drum 92 before the effect of a preceding impulse has been expended will not disengage the one way clutch and will in fact superimpose an additional loading on the spring 86 so that the force applied to driving shaft 22 will amount to that represented by an accumulation of impulses until the shaft 22 attains the required speed. Thus when the shaft 22 (and consequently the fly wheel) is being started from rest the initial period of acceleration will be caused by a fairly rapid build up in the loading of the spring 86 and the force of the spring will be greatest when the greatest force is needed.

In any of the arrangements described it is contemplated that any desired number of one way clutches and associated spring actuated means may be provided to suit particular requirements the actuation of the clutches being arranged to take place in seriatim by appropriate setting of the cam projections on the cam shaft. Thus the required build up of a train of driving impulses in quick succession can be applied to the driving shaft 22 to effect a smooth and rapid acceleration of the fly wheel up to full speed in an economical manner. Obviously any of the impulse transmitting means extending from lever arms 29 shown may be used in any of the several forms of construction illustrated.

WHAT I CLAIM IS:—

1. Mechanism for starting up and/or driving a heavy fly wheel from a low power high speed prime mover, comprising a cam shaft adapted to be driven through a reduction gear from the prime mover, a driving shaft adapted to be coupled to the fly wheel, a driving shaft adapted to be coupled to the fly wheel, spring actuated means for imparting driving impulses to the driving shaft, and means on the cam shaft for periodically loading the spring of said spring actuated means during rotation of the cam shaft.

2. Mechanism according to Claim 1 having a plurality of spring actuated means acting at different positions on the driving shaft and each associated with separate spring loading means on the cam shaft which are timed to operate in sequence during the rotation of the cam shaft.

3. Mechanism according to Claim 1 or 2 wherein the spring actuated means or each of them comprises a one way clutch having driving and driven members and a spring which in its loaded state urges the driving member of said clutch in the direction to engage its driven member and thereby transmit a drive to the driving shaft.

4. Mechanism according to Claim 3 wherein the driving member of the or each one way clutch is coupled to an operating lever by means of a chain engaging with a chain wheel associated with the driven member of the one way clutch, the arrangement of the chain coupling being such that the chain is maintained taut and a comparatively small amount of movement of the said operating lever turns the driving member of the one way clutch through more than half a complete rotation.

5. Mechanism according to Claim 3 wherein the driving member of the or each one way clutch is coupled to a lever between which and a fixed anchorage there is mounted the spring specified in Claim 3 the said lever

being adapted to be rocked periodically by a cam or other offset projection on the cam shaft in the direction to load the said spring and in so doing to move the driving member of the clutch in the free direction in relation to its driven clutch member.

6. Mechanism according to Claim 5 having a plurality of spring actuated means and having the levers associated respectively with them operated by different cams or similar offset projections on the cam shaft which are timed to give a sequence of actuations.

7. Mechanism according to Claim 3 wherein the spring actuated means or each of a plurality thereof comprises a one way clutch having a rotary driving member which is coupled through a plurality of circumferentially spaced tension or compression springs to a stationary plate or disc and wherein the said rotary driving member is also connected through a direct linkage or linkages or chain and sprocket mechanism to a lever operated by a cam or similar offset projection on the cam shaft, so as to be turned against the action of said springs and in the free direction when actuated by the cam or other offset projection.

8. Mechanism according to Claim 3 wherein the spring actuated means or each of a plurality thereof comprises a one way clutch the driving member of which is operated in the driven member engaging direction by a spring coiled around the driving shaft and contained in a drum, which spring is loaded by winding it up in accordance with impulses applied to an operating lever by a cam or other offset projection on the cam shaft.

9. Mechanism according to Claim 8 wherein the spring in said drum is arranged to receive and accumulate a succession of loading impulses and to apply to said driving member a driving force corresponding to such accumulation of impulses.

10. Mechanism according to any of the preceding Claims comprising in addition a prime mover and a disengageable clutch for connecting it to the fly wheel or a shaft coupled thereto.

11. Mechanism for starting up and or driving a heavy fly wheel constructed and arranged substantially in accordance with any of the embodiments hereinbefore described with reference to the accompanying drawings.

ERIC POTTER AND CLARKSON,
Chartered Patent Agents.

PROVISIONAL SPECIFICATION

Fly Wheel Starting or Driving Mechanism

I, ALBERT VICTOR CLARKE, a British Subject, of 2, Went Road, Birstall, Leicestershire, do hereby declare this invention to be described in the following statement: —

This invention relates to a fly wheel starting and driving mechanism and has for an object to provide effective and economical means for accumulating mechanical energy.

In accordance with the invention there is provided mechanism for starting up and/or driving a heavy fly wheel from a low power high speed prime mover comprising a cam shaft adapted to be driven through a reduction gear from the prime mover, a driving shaft adapted to be coupled to the fly wheel, spring actuated means for imparting driving impulses to the driving shaft and means on the cam shaft for periodically loading the spring of said spring actuated means during rotation of the cam shaft. Thus during the operation of the mechanism the cam shaft causes a succession of loadings of the spring to occur in the intervals between which the spring becomes unloaded in applying driving impulses to the driving shaft. In a preferred form of the mechanism there are provided a plurality of spring actuated means acting at different positions on the driving shaft and each associated with separate spring loading means on the cam shaft which are timed to operate in sequence during the rotation of the cam shaft. Thus in effect at each rotation of the cam shaft the plurality of spring actuated means have their springs loaded in sequence and thereby caused to impart a succession of pulses to the driven shaft which are cushioned due to the resilience of the springs and spread over the period of unloading thereof.

By the use of apparatus in accordance with the invention a heavy fly wheel can be started up from rest and caused to rotate a high speed in a particularly effective, economical and expeditious manner, the fly wheel then being caused to drive any desired machine or apparatus. The mechanism may be employed to maintain the fly wheel rotating by continuing to supply a succession of cushioned impulses to its driving shaft or alternatively other driving means (such as a second prime mover) may be brought into action to maintain the speed of rotation of the fly wheel after it has been brought up to full speed. It will be appreciated that the power required from such second prime mover is only that necessary to prevent the fly wheel from losing speed and is substantially less than that which would be needed by a direct drive to start the fly wheel into motion from rest in a short period of time. Such second prime mover would be chosen or designed as one suitable to supply the requisite power for the drive which is to be taken from the rotating fly wheel.

In a convenient form of construction the spring actuated means for applying cushioned impulses to the driving shaft (or each of a plurality of such means) comprises a one way

clutch and a spring which in its loaded state urges the driving member of such clutch in the direction to engage its driven member and thereby transmit a drive to the driving shaft. The spring actuated one way clutch device may take various forms. In one construction the driving member of the one way clutch is coupled to a lever between which and a fixed anchorage there is mounted a tension spring, the said lever being adapted to be rocked periodically by the cam, crank or offset projection on the cam shaft in the direction to load the tension spring and in so doing to move the driving member of the clutch in the free direction in relation to its driven clutch member. On release of the lever by the said cam crank or projection the loaded spring urges the lever and driving clutch member in the reverse direction thereby causing the driving clutch member to engage its driven member and transmit a driving impulse to the driving shaft during the remainder of the rotation of the cam shaft. A plurality of spring actuated one way clutches arranged at spaced intervals on the driving shaft and co-operating with corresponding levers operated by cams, cranks or projections similarly spaced along the cam shaft which are timed to give a sequence of actuations, can be employed to impart a rapid succession of impulses from the springs to the driven shaft. Thus the power required to operate the cam shaft to load the springs need only be sufficient to load one spring at a time.

In an alternative form of construction the spring actuated inpulse applying means or each of a plurality thereof comprises a one way clutch having its rotary driving member coupled through a plurality of circumferentially spaced tension or compression springs to a stationary plate or disc and the rotary driving clutch member is also connected through direct linkages or linkage and lever mechanism to the cam crank or offset projection on the cam shaft so as to be turned against the action of said springs and in the free direction when actuated by the cam, crank or projection. On release by the latter the springs urge the driving clutch member in the engaging direction causing it to pick up the driving member and drive it through part of a rotation under the force of the springs which thereby become unloaded resetting the mechanism for repeated operation by the cam shaft. In a further alternative form of construction the driving clutch member is operated by a spring coiled around the driven shaft and corresponding in form to a clock or gramophone spring such spring being contained in a drum like casing which is shogged around the driving shaft through pawl and ratchet mechanism coupled by linkage to be operated by a cam crank or projection on the cam shaft, there being a holding pawl to retain the drum in each position to which it is moved by operation of the cam shaft. With this last construction the spring drum is turned step by step to supply the impulses to the driven shaft through the coiled spring the action of which serves to urge the driving clutch member in the direction to pick up and drive the driven clutch member and thereby apply a driving impulse to the driven shaft as the spring becomes unloaded. This latter form of construction enables a succeeding impulse to be applied to the clutch actuating spring before it has become fully unloaded from a previous actuation thus permitting a building up of spring force acting on the driving clutch member from successive actuations if the driven shaft has had insufficient time to respond completely to a previously impulse or impulses applied through the one way clutch.

In a convenient form of apparatus a small low power high speed electric motor is employed as the prime mover to operate the cam shaft through a speed reduction gear thus giving the motor a mechanical advantage in driving the cam shaft. The cam shaft is formed with, or has fixed to it, at each of a plurality of spaced positions, a cam, crank or other projection for actuating the corresponding one of a similar plurality of spring means associated each with a separate one way clutch on a driven spindle substantially parallel to the cam shaft. The driven spindle is coupled, for example by gearing, to a heavy fly wheel, and the gearing or other coupling means may provide the driven shaft with a mechanical advantage in relation to the fly wheel. The spring actuated means may take any of the forms described above and the plurality of cams, cranks or other projections arranged on the cam shaft are timed to act in sequence at spaced time intervals during rotation of the cam shaft so that only one cam, crank or projection actuates the relative spring means at any time. The one way clutches arranged on the driving shaft may each take the form of an overrunning dog clutch having a plurality of alternative positions of engagement for one way transmission of motion only or alternatively they may be clutches capable of instantaneous engagement at any relative position of the driving and driven clutch members for transmission of motion in one direction while permitting free movement between such members in the opposite direction. Desirably there is a shaft also coupled to the fly wheel to rotate therewith carrying an engageable and dis-engageable clutch through which a second electric motor may be coupled to the fly wheel to maintain it rotating when it has been brought up to full speed so that when the fly wheel has been brought up to speed the second motor may take up the drive and the first motor be de-energised.

It will be understood that mechanism as above described employing a plurality of one way clutches arranged to transmit impulses in

sequence to the driven shaft has an action comparable to that of a multi-cylinder piston engine but with the advantage that each of the driving impulses applied to the driven shaft is balanced about the axis of the latter instead of being laterally offset as in the case of a piston and crank drive.

An arrangement of mechanism as already described may be employed with the flywheel serving to drive an alternator or other generator of electrical power with the fly wheel coupled to the rotor shaft of the generator. The electrical generator can then be driven at a steady speed from the power stored in the flywheel and it may be practicable to improve the efficiency of the system by feeding back some of the power output of the generator to the second electrical driving motor aforementioned used for maintaining the speed of the flywheel after it has been started up by the impulse applying mechanism.

ERIC POTTER AND CLARKSON,
Chartered Patent Agents.

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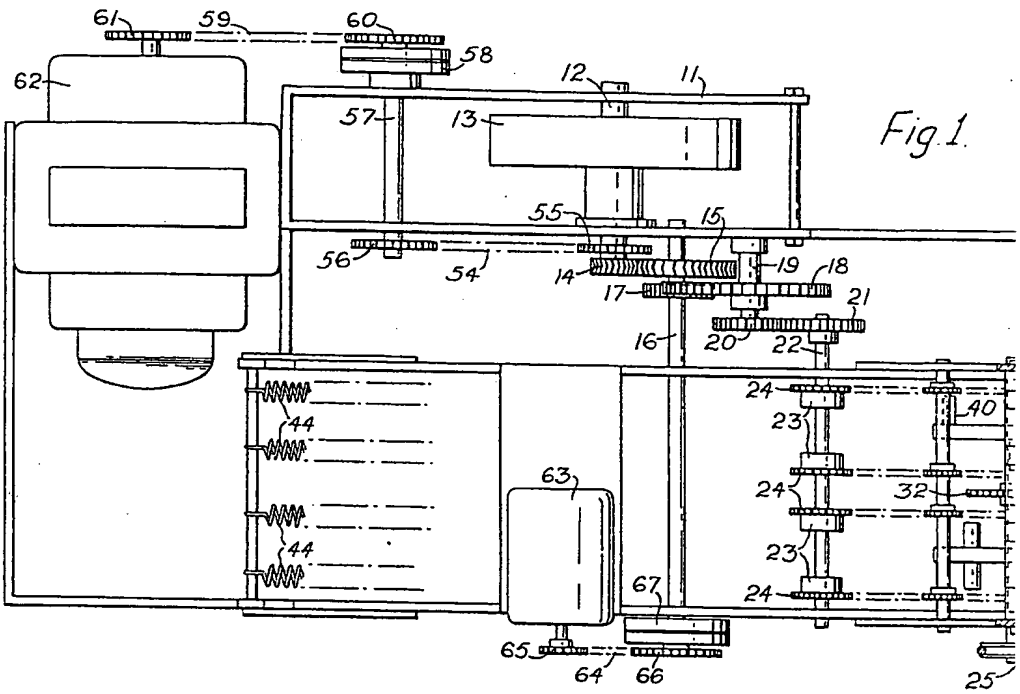
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Fig. 1.

Fig. 2.

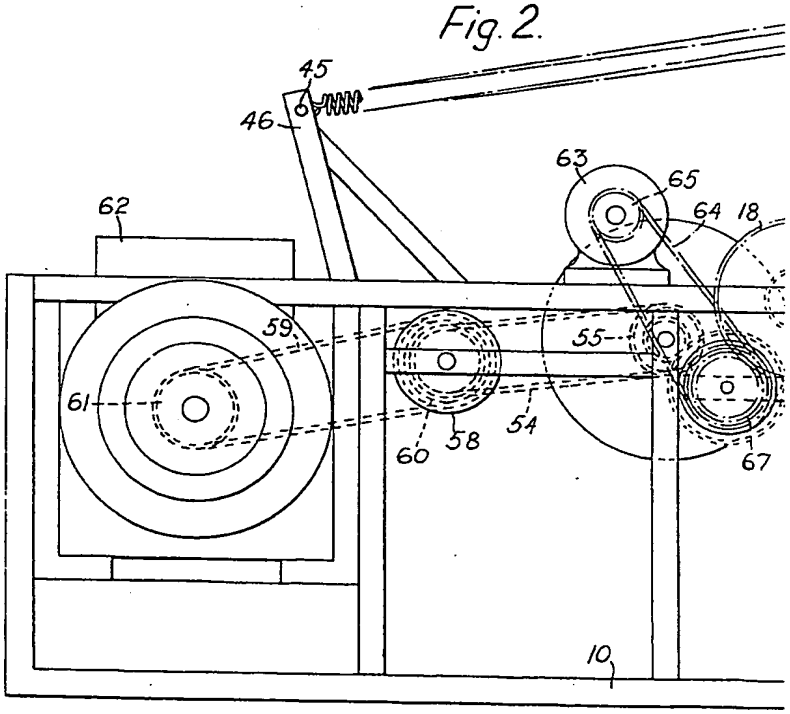
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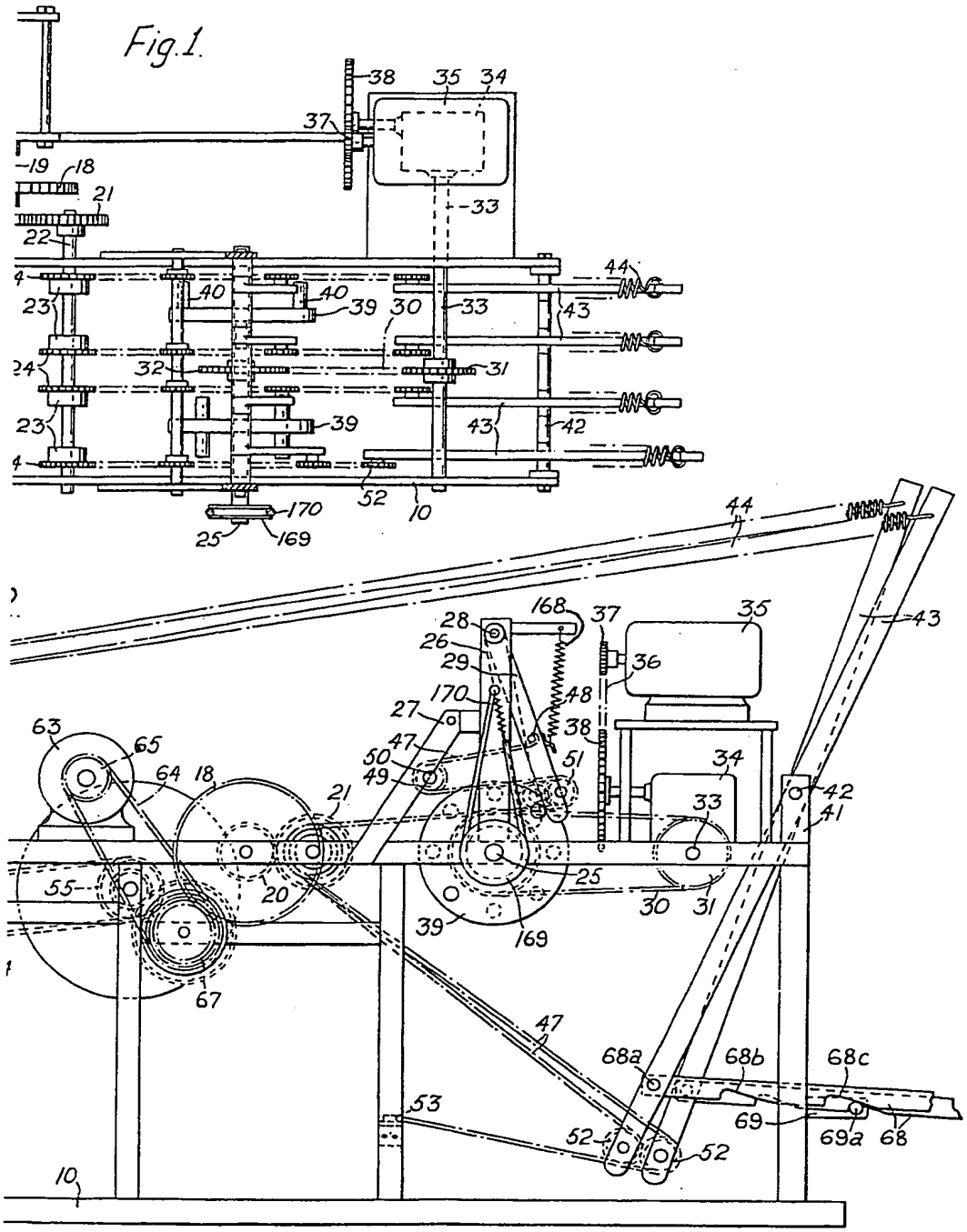
Fig. 1.



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Sheet 1

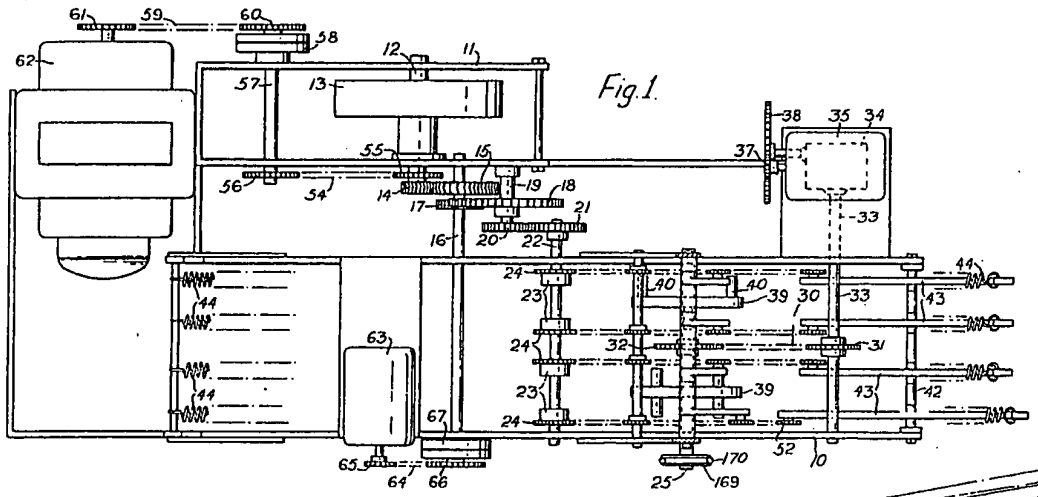

Fig. 1.

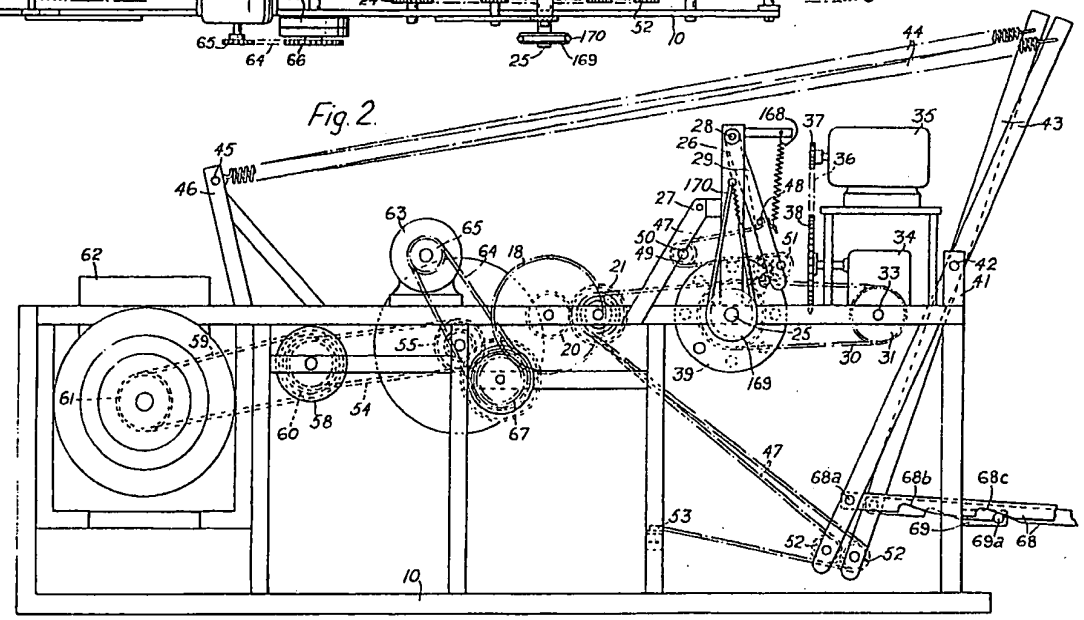

Fig. 2.

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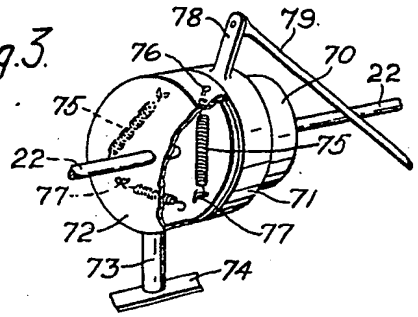
Sheet 2

Fig.3.



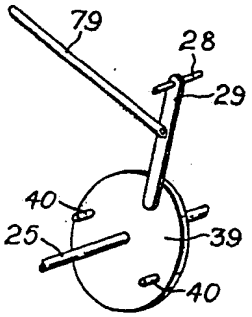
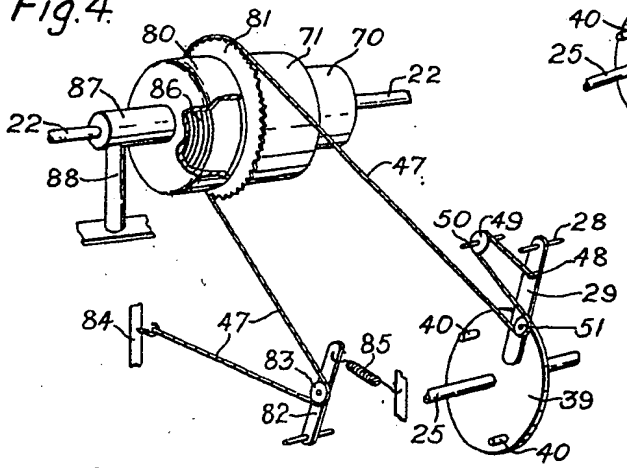


Fig.4.



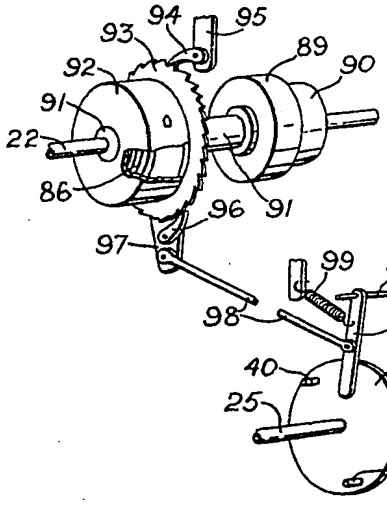


Fig.5.